



FIG. 1

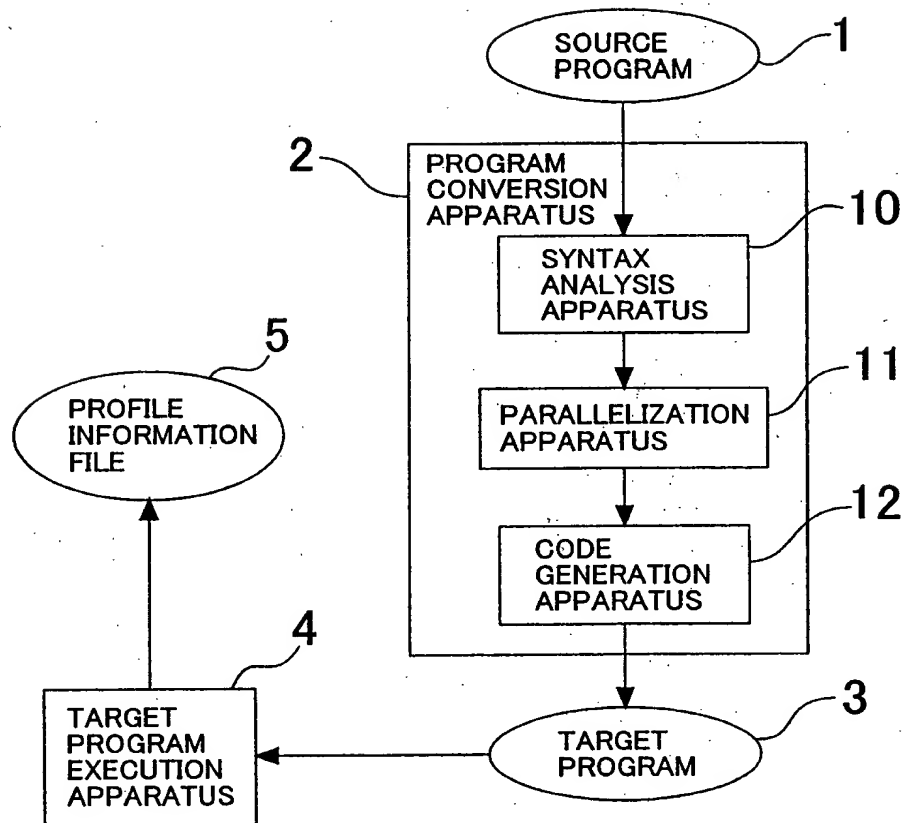


FIG. 2

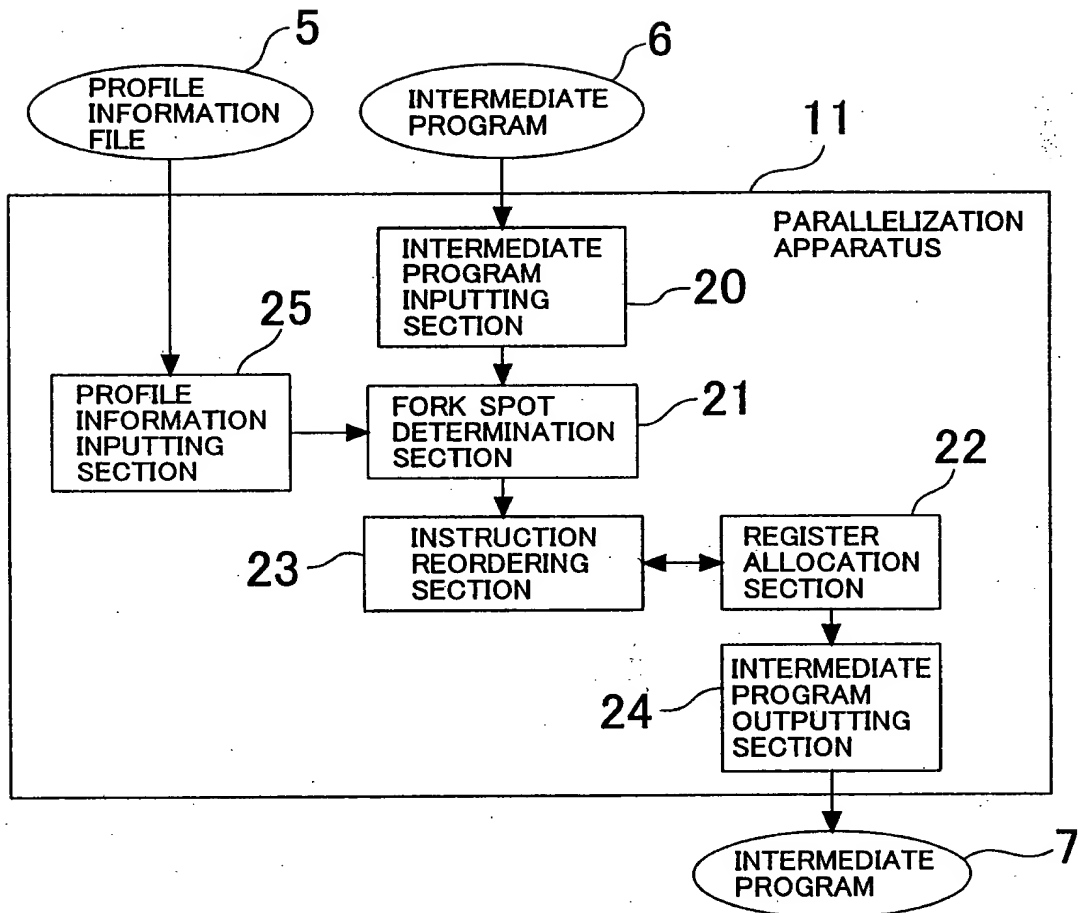


FIG. 3

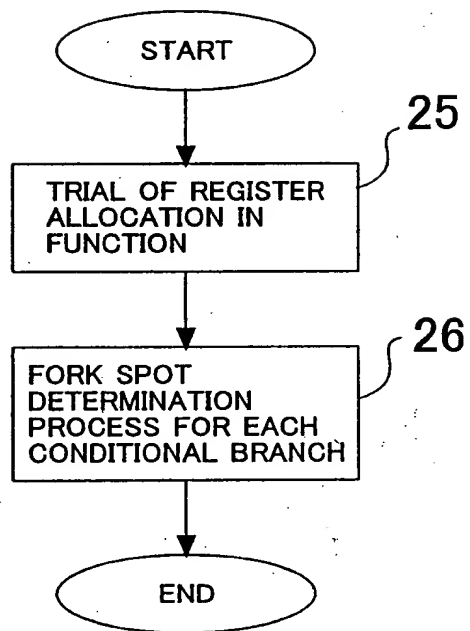


FIG. 5

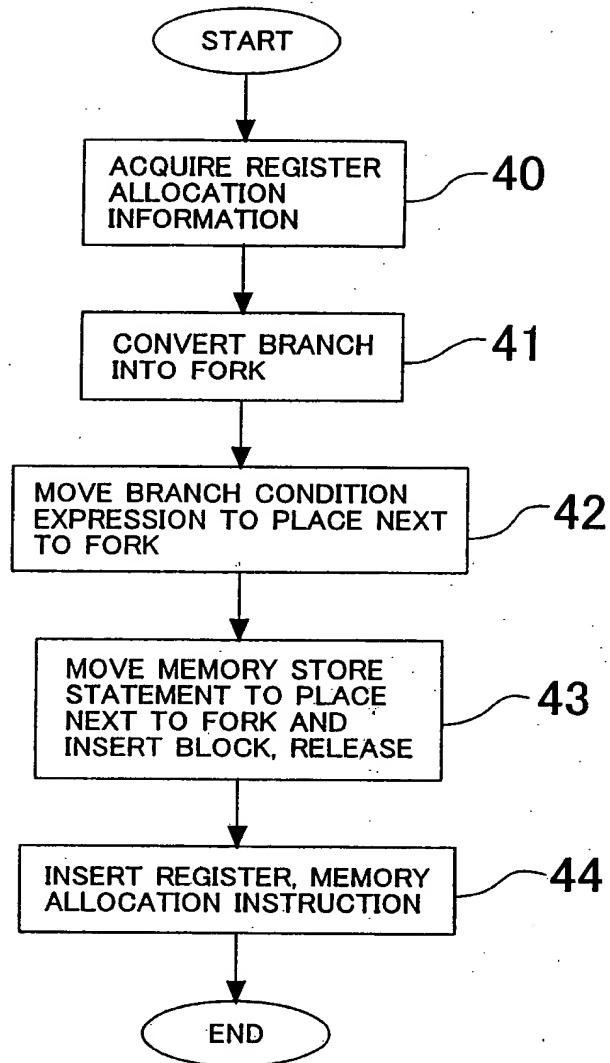


FIG. 4

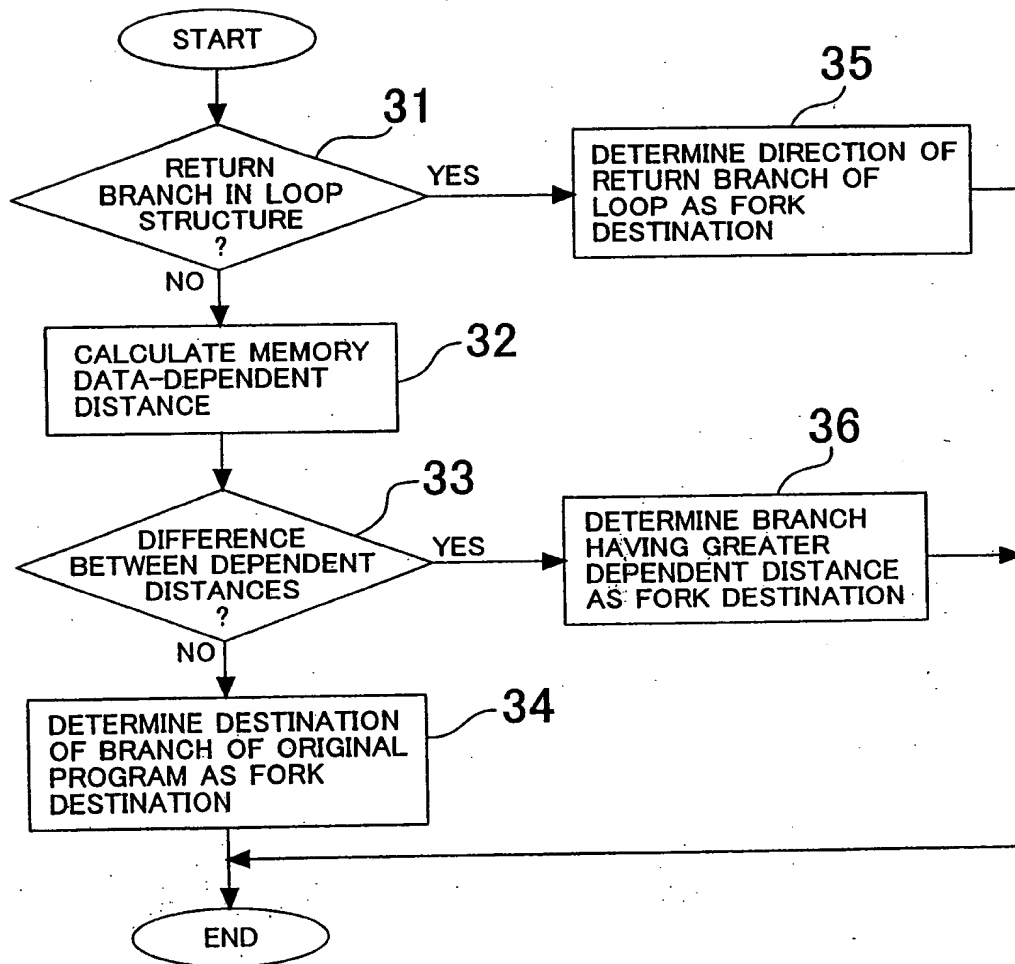


FIG. 6(A)

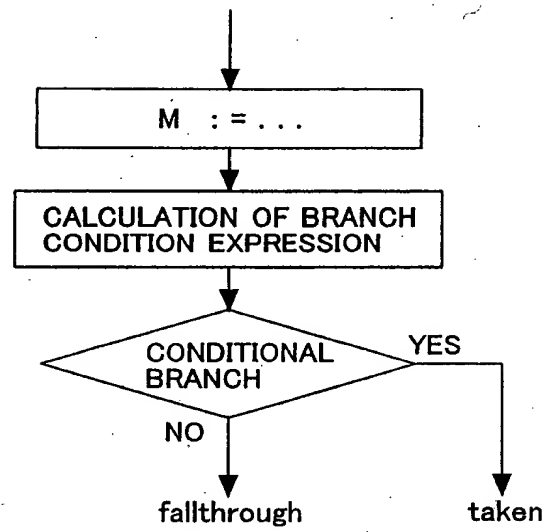


FIG. 6(B)

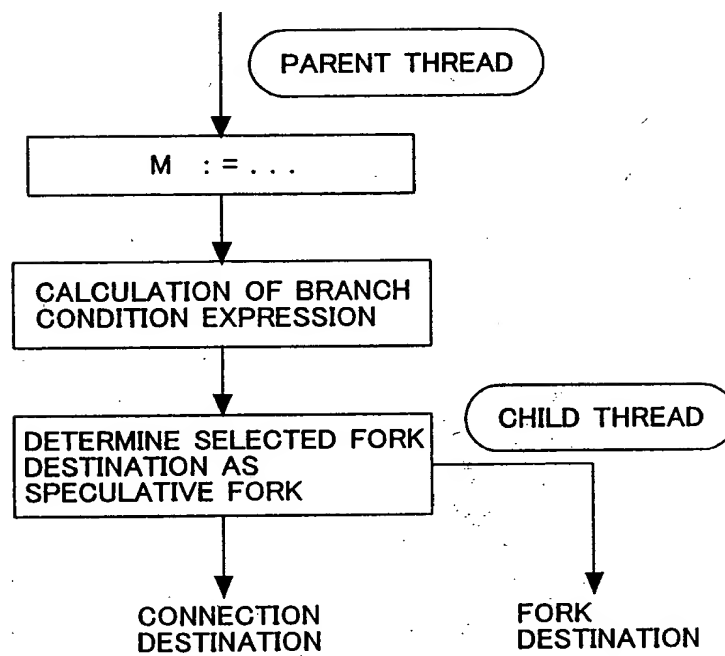


FIG. 6(C)

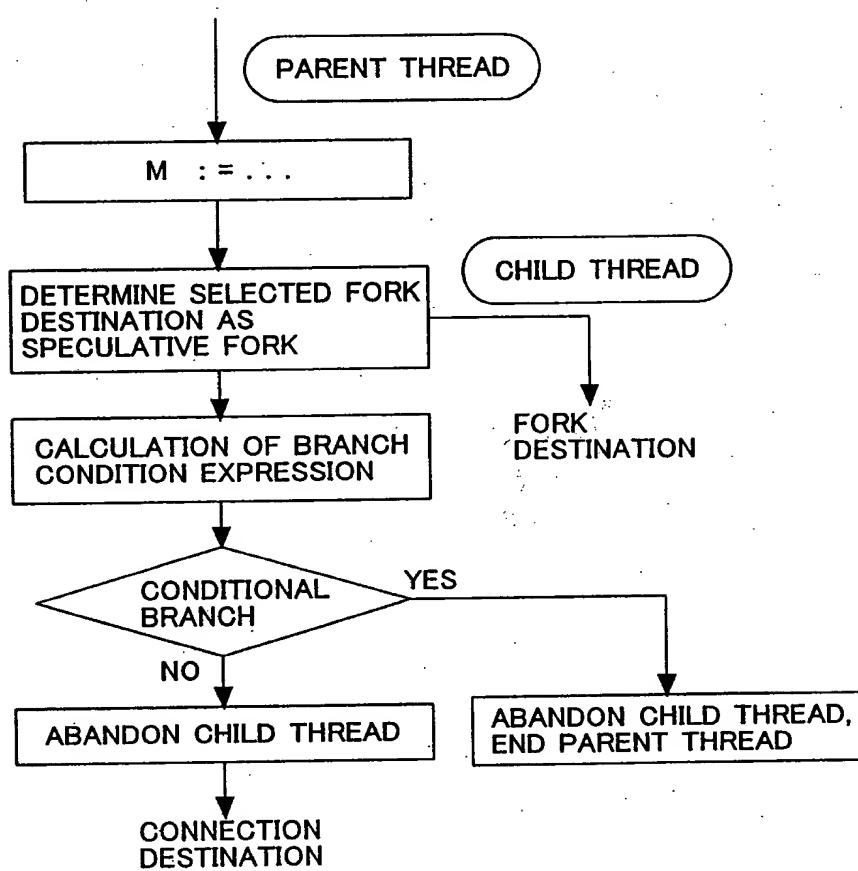




FIG. 6(D)

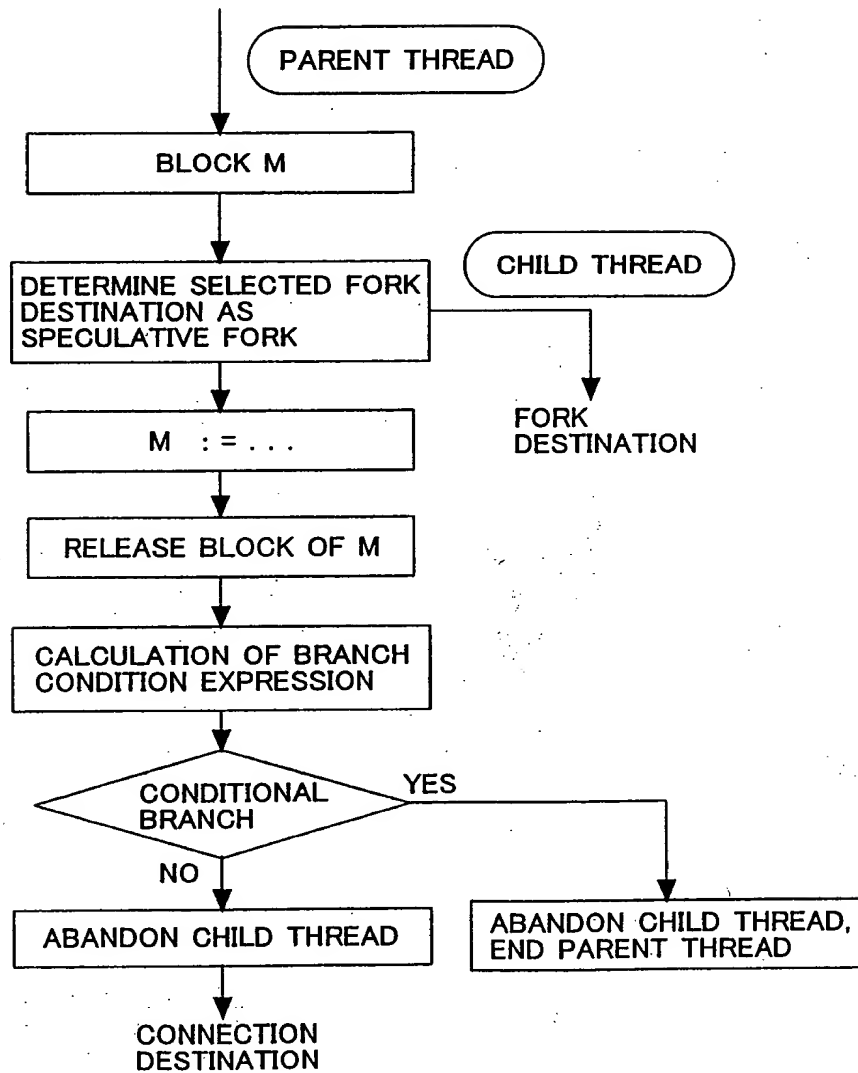


FIG. 6(E)

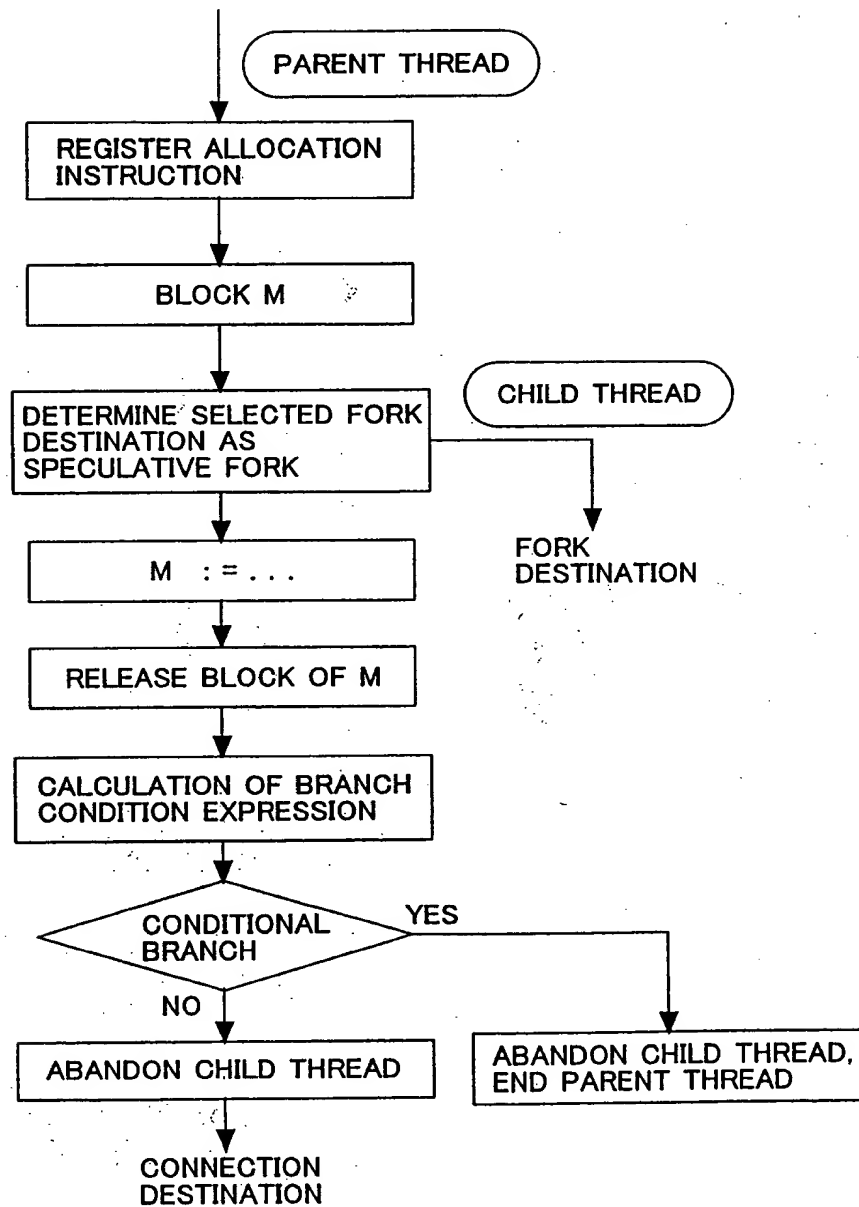


FIG. 7

SPFORK 1	TO CREATE A SPECULATION MODE CHILD THREAD FOR STARTING EXECUTION FROM 1
TTERM c	TO END SELF THREAD AND SETTLE CHILD THREAD IF C IS TRUE
FTERM c	TO END SELF THREAD AND SETTLE CHILD THREAD IF C IS FALSE
THABORT	TO ABANDON A CHILD THREAD OF A SPECULATION MODE
BLACK m	TO DESIGNATE A MEMORY ADDRESS DESIGNATED WITH M AS BLOCK
RELEASE m	TO CLEAR BLOCK SET TO MEMORY ADDRESS DESIGNATED WITH M
DSPIN	TO CREATE A CHILD THREAD CREATED BY SUCCEEDING FORK IN DATA-DEPENDENT SPECULATION MODE
DSPOUT	TO CLEAR DATA-DEPENDENT SPECULATION MODE OF CHILD THREAD
RDCL t,...	TO INSTRUCT TO ALLOCATE INTERMEDIATE TERMS/VARIABLES DESIGNATED WITH t, ... TO REGISTER
MDCL t,...	TO INSTRUCT TO ALLOCATE INTERMEDIATE TERMS/VARIABLES DESIGNATED WITH t, ... TO MEMORY

FIG. 8

```
( 1)  t1 := &X
( 2)  t2 := I
( 3)  t3 := 4
( 4)  t4 := t2 * t3
( 5)  t5 := t1 + t4
( 6)  t6 := 1
( 7)  mem(t5) := t6
( 8)  t7 := I
( 9)  t8 := 20
(10)  t9 := t7 > t8
(11)  if false then goto L2
(12)  L1:
(13)  t10 := &X
(14)  t11 := J
(15)  t12 := 4
(16)  t13 := t11 * t12
(17)  t14 := t10 + t13
(18)  t15 := mem(t14)
(19)  t16 := J
(20)  t17 := t15 + t16
(21)  R := t17
(22)  goto L3
(23)  L2:
(24)  t18 := K
(25)  t19 := 10
(26)  t20 := t18 / t19
(27)  R := t20
(28)  t21 := &X
(29)  t22 := J
(30)  t23 := 4
(31)  t24 := t22 * t23
(32)  t25 := t21 + t24
(33)  t26 := mem(t25)
(34)  t27 := R
(35)  t28 := t26 + t27
(36)  R := t28
(37)  L3:
```

(B1)

(B2)

(B3)

FIG. 9

(51)	t1 := &X	}	(B1)
(52)	t2 := I		
(53)	t3 := 4		
(54)	t4 := t2 * t3		
(55)	t5 := t1 + t4		
(56)	t6 := 1		
(57)	mem(t5) := t6		
(58)	SPFORK L2		
(59)	t7 := I		
(60)	t8 := 20		
(61)	t9 := t7 > t8	}	(B2)
(62)	FTERM		
(63)	THABORT		
(64)	goto L1		
(65)	L1:		
(66)	t10 := &X		
(67)	t11 := J		
(68)	t12 := 4		
(69)	t13 := t11 * t12		
(70)	t14 := t10 + t13		
(71)	t15 := mem(t14)	}	(B3)
(72)	t16 := J		
(73)	t17 := t15 + t16		
(74)	R := t17		
(75)	goto L3		
(76)	L2:		
(77)	t18 := K		
(78)	t19 := 10		
(79)	t20 := t18 / t19		
(80)	R := t20		
(81)	t21 := &X		
(82)	t22 := J		
(83)	t23 := 4		
(84)	t24 := t22 * t23		
(85)	t25 := t21 + t24		
(86)	t26 := mem(t25)		
(87)	t27 := R		
(88)	t28 := t26 + t27		
(89)	R := t28		
(90)	L3:		

FIG. 10

(101)	t1 := &X	}	(B1)
(102)	t2 := I		
(103)	t3 := 4		
(104)	t4 := t2 * t3		
(105)	t5 := t1 + t4		
(106)	BLOCK t5		
(107)	SPFORK L2		
(108)	t6 := 1		
(109)	mem(t5) := t6		
(110)	RELEASE t5		
(111)	t7 := I	}	(B2)
(112)	t8 := 20		
(113)	t9 := t7 > t8		
(114)	FTERM		
(115)	THABORT		
(116)	goto L1		
(117)	L1:		
(118)	t10 := &X		
(119)	t11 := J		
(120)	t12 := 4		
(121)	t13 := t11 * t12	}	(B3)
(122)	t14 := t10 + t13		
(123)	t15 := mem(t14)		
(124)	t16 := J		
(125)	t17 := t15 + t16		
(126)	R := t17		
(127)	goto L3		
(128)	L2:		
(129)	t18 := K		
(130)	t19 := 10		
(131)	t20 := t18 / t19		
(132)	R := t20		
(133)	t21 := &X		
(134)	t22 := J		
(135)	t23 := 4		
(136)	t24 := t22 * t23		
(137)	t25 := t21 + t24		
(138)	t26 := mem(t25)		
(139)	t27 := R		
(140)	t28 := t26 + t27		
(141)	R := t28		
(142)	L3 :		

FIG. 11

(201)	RDCL t1 - t9	{	(B1)
(202)	RDCL I		
(203)	MDCL X		
(204)	t1 := &X		
(205)	t2 := I		
(206)	t3 := 4		
(207)	t4 := t2 * t3		
(208)	t5 := t1 + t4		
(209)	BLOCK t5		
(210)	SPFORK L2		
(211)	t6 := 1		
(212)	mem(t5) := t6		
(213)	RELEASE t5	{	(B2)
(214)	t7 := I		
(215)	t8 := 20		
(216)	t9 := t7 > t8		
(217)	FTERM		
(218)	THABORT		
(219)	goto L1		
(220)	L1:		
(221)	RDCL t10 - t17		
(222)	RDCL R		
(223)	MDCL X, J		
(224)	t10 := &X		
(225)	t11 := J		
(226)	t12 := 4		
(227)	t13 := t11 * t12		
(228)	t14 := t10 + t13		
(229)	t15 := mem(t14)		
(230)	t16 := J	{	(B3)
(231)	t17 := t15 + t16		
(232)	R := t17		
(233)	goto L3		
(234)	L2:		
(235)	RDCL t18 - t28		
(236)	RDCL R		
(237)	MDCL X, J		
(238)	t18 := K		
(239)	t19 := 10		
(240)	t20 := t18 / t19		
(241)	R := t20		
(242)	t21 := &X		
(243)	t22 := J		
(244)	t23 := 4		
(245)	t24 := t22 * t23		
(246)	t25 := t21 + t24		
(247)	t26 := mem(t25)		
(248)	t27 := R		
(249)	t28 := t26 + t27		
(250)	R := t28		
(251)	L3 :		

FIG. 12

```
(255) r21 := &X
(256) r22 := r11
(257) r23 := 4
(258) r24 := r22 * r23
(259) r25 := r21 + r24
(260) BLOCK r25
(261) SPFORK L2
(262) r26 := 1
(263) mem(r25) := r26
(264) RELEASE r25
(265) r27 := r11
(266) r28 := 20
(267) r29 := r27 > r28
(268) FTERM r29
(269) THABORT
(270) goto L1
(271) L1:
(272) r20 := &X
(273) r21 := mem(&J)
(274) r22 := 4
(275) r23 := r21 * r22
(276) r24 := r20 + r23
(277) r25 := mem(r24)
(278) r26 := mem(&J)
(279) r27 := r25 + r26
(280) r12 := r27
(281) goto L3
(282) L2:
(283) r20 := r13
(284) r21 := 10
(285) r22 := r20 / r21
(286) r12 := r22
(287) r23 := &X
(288) r24 := mem(&J)
(289) r25 := 4
(290) r26 := r24 * r25
(291) r27 := r23 + r26
(292) r28 := mem(r27)
(293) r29 := r12
(294) r30 := r28 + r29
(295) r12 := r30
(296) L3:
```



FIG. 13

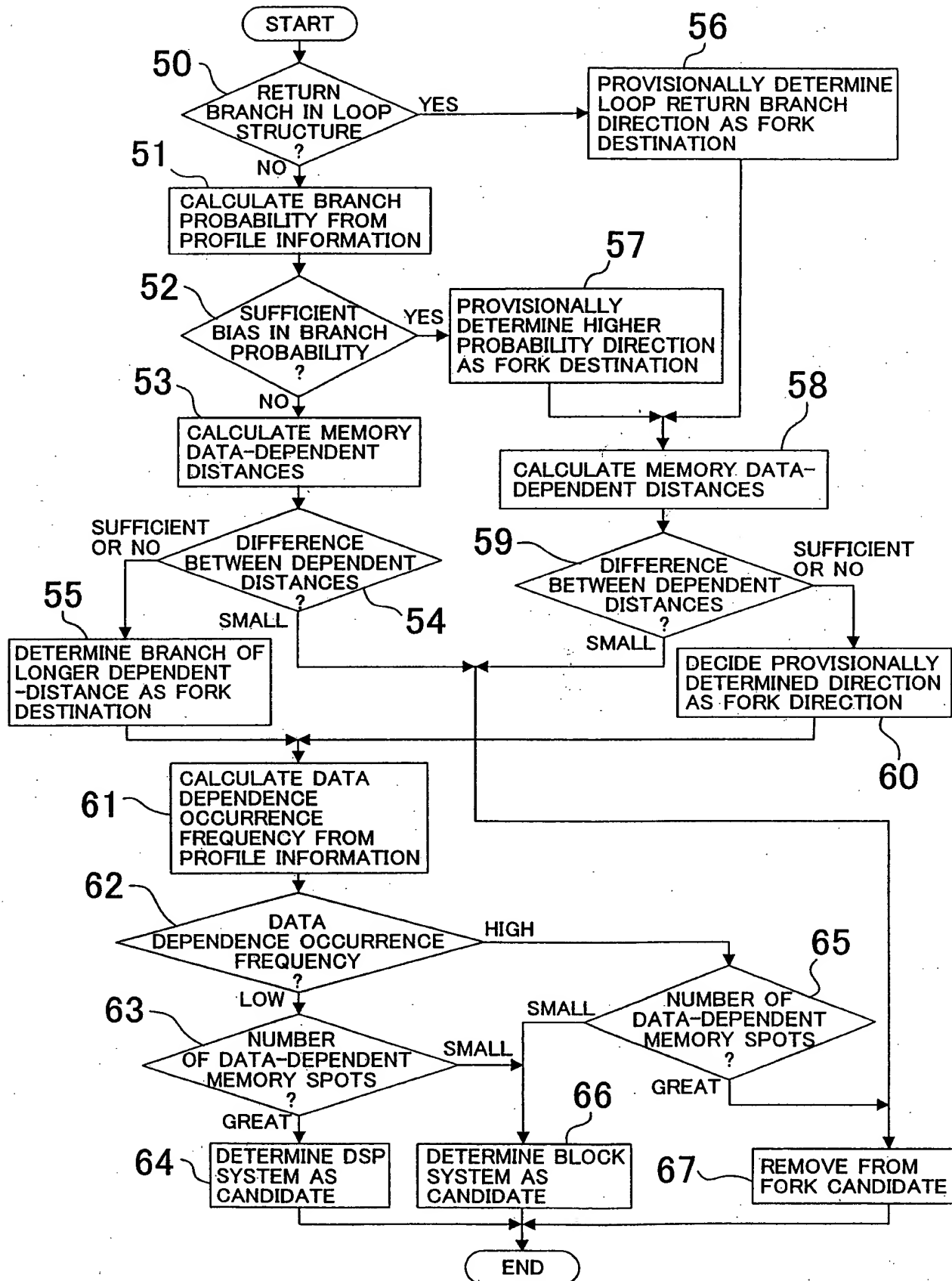


FIG. 14

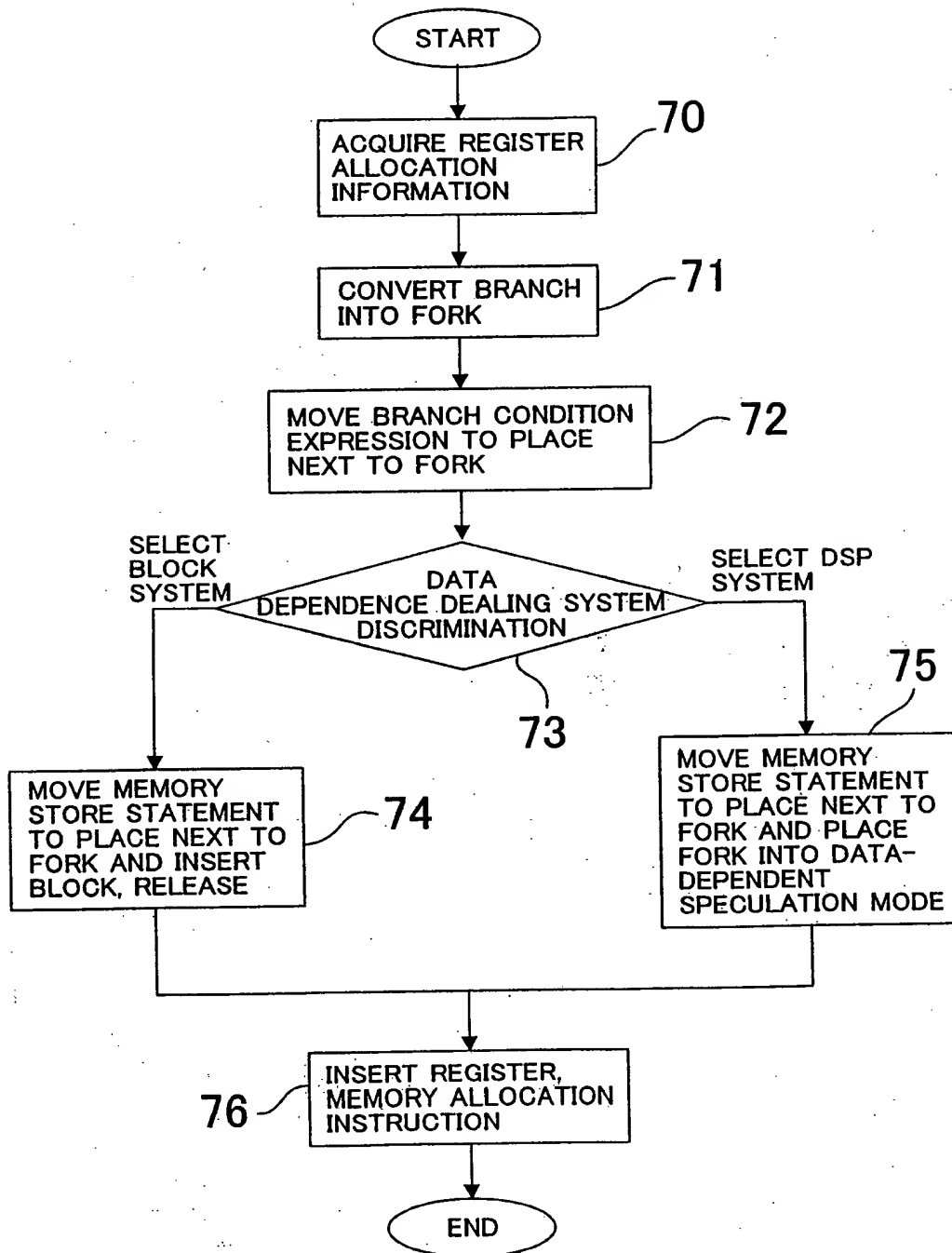
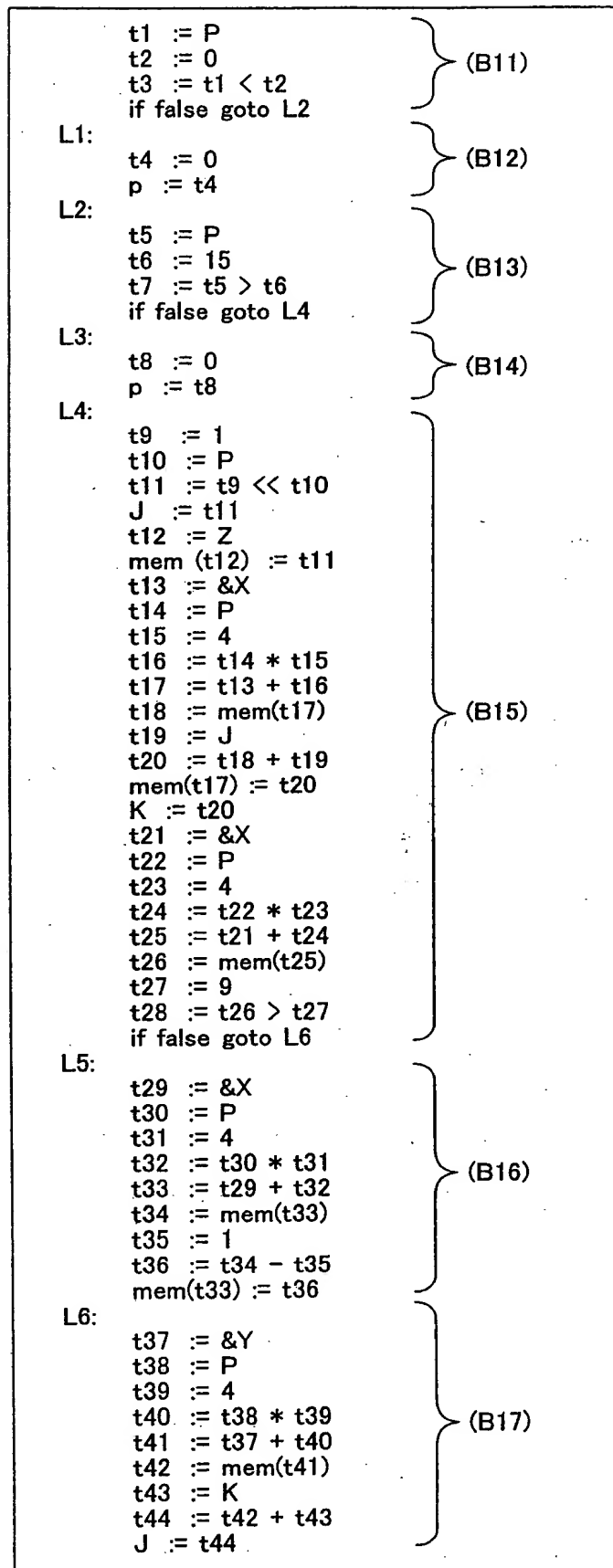


FIG. 15



**FIG. 16(A)**

BRANCHING NUMBER

B I1	B I2: 2D	B I3: I8D
B I3	B I4: 3D	B I5: I7D
B I5	B I6: 3D	B I7: I7D

**FIG. 16(B)**

MEMORY DATA DEPENDENCE

B I5 → B I6	I2D
B I5 → B I7	4

FIG. 17

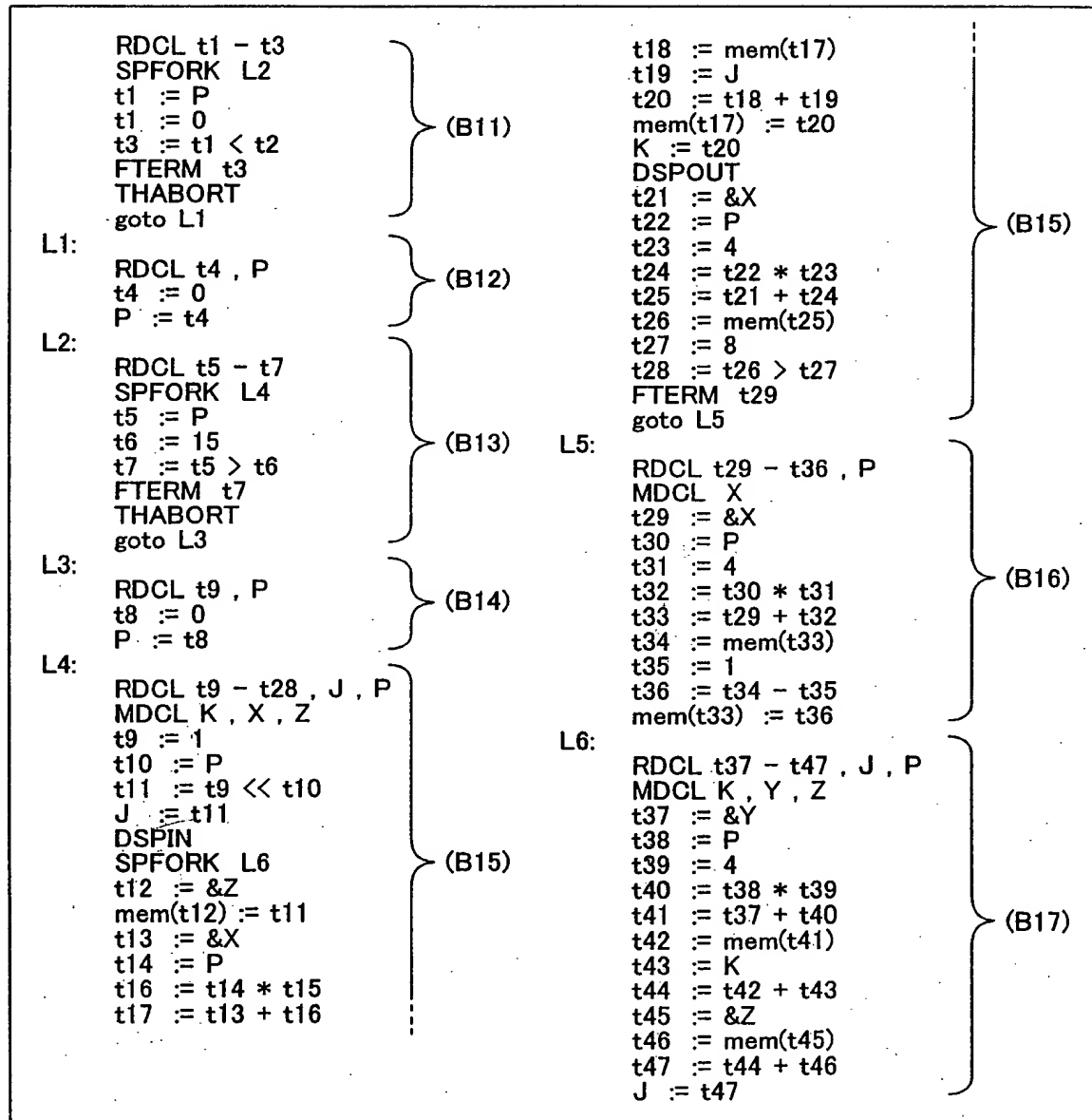


FIG. 18

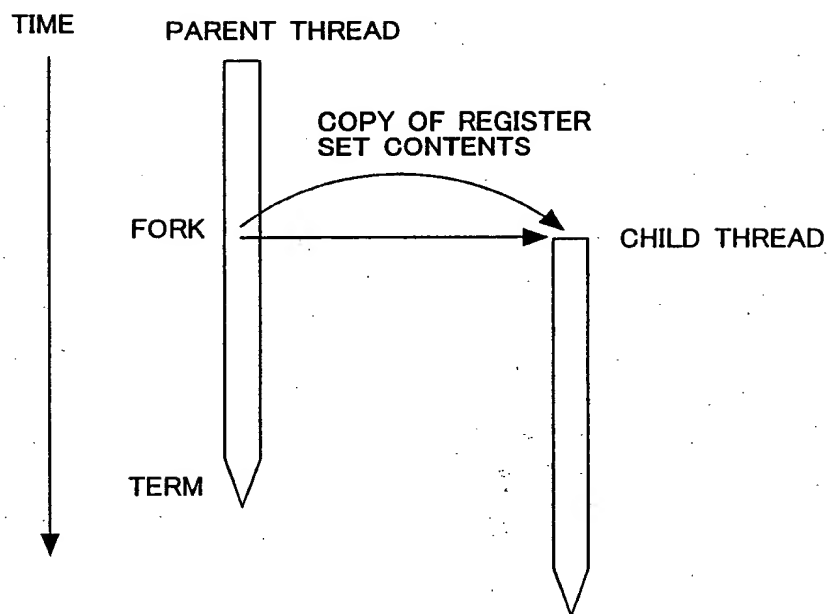


FIG. 19

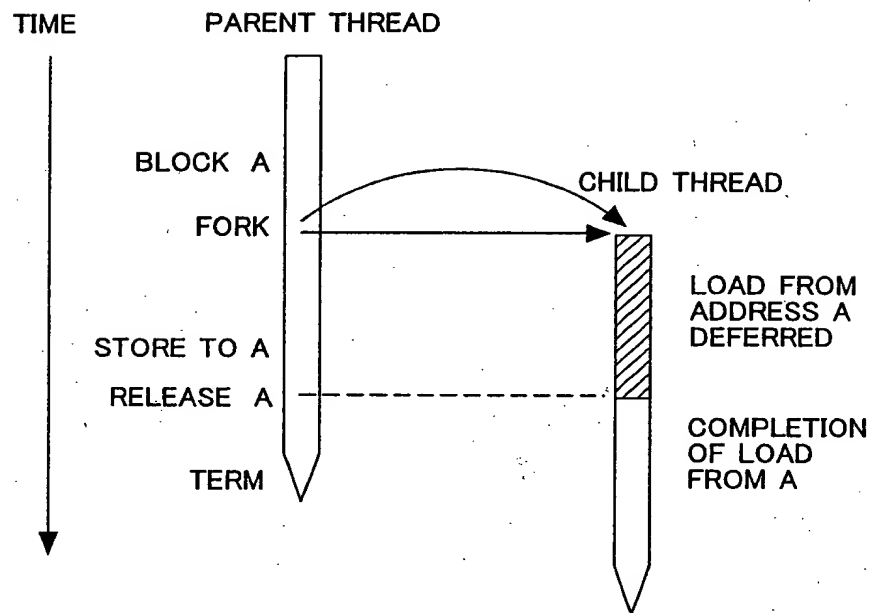


FIG. 20(A)

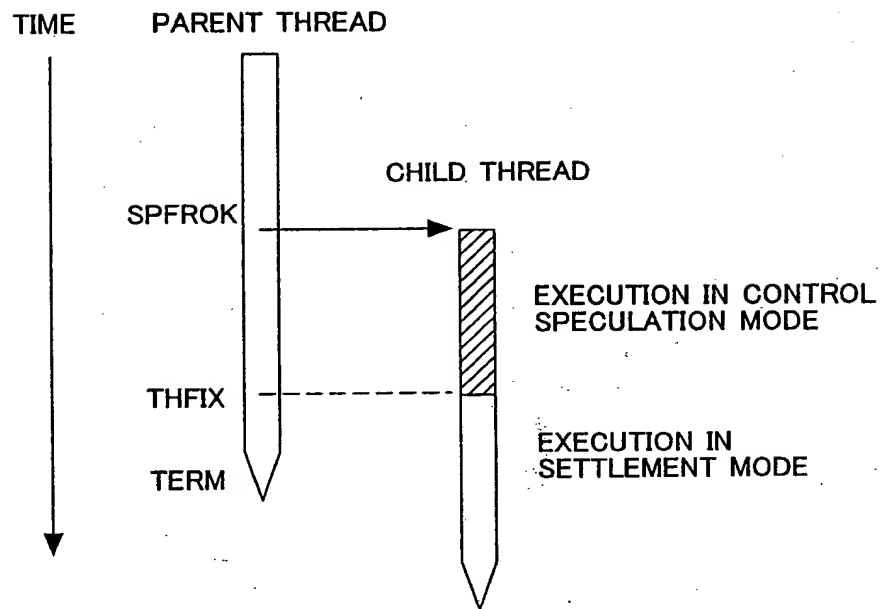




FIG. 20(B)

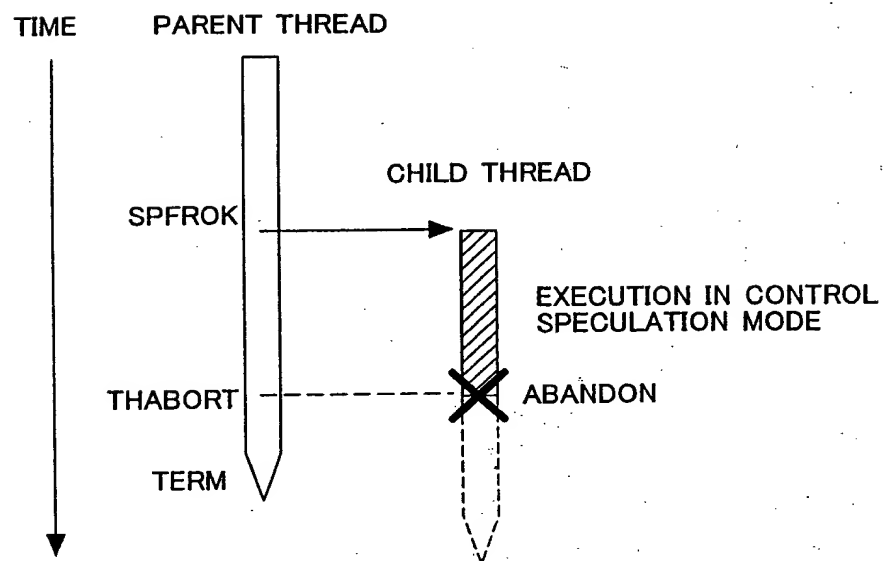


FIG. 21

